

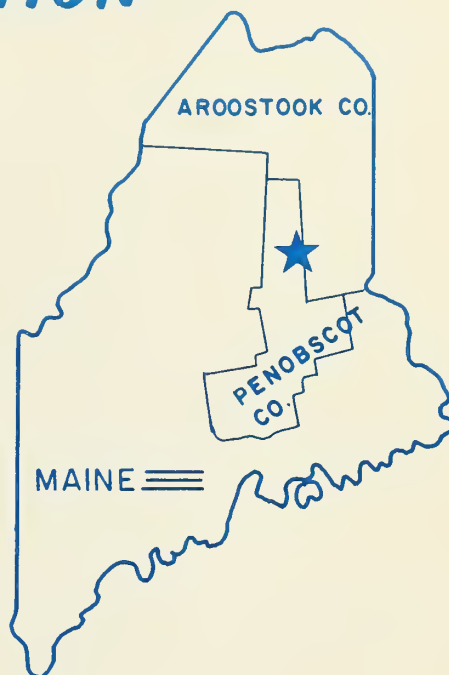
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# **WORK PLAN**

**FOR:**  
**WATERSHED PROTECTION**  
**FLOOD PREVENTION**  
**RECREATION**



# **FISH      STREAM**

# **WATERSHED**

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KENNETH M. CURTIS  
GOVERNOR

September 11, 1969

Mr. Kenneth Grant  
Administrator  
Soil Conservation Service, USDA  
Washington, D. C.

Dear Mr. Grant:


It is with pleasure that I send you my comments on the Work Plan for the Fish Stream Small Watershed Project in Penobscot County, Maine.

Recent flood history within this watershed has been most serious. I feel that the sponsors of this project are to be commended for their foresight in planning ahead to reduce the threat of a recurrence of such damage.

Maine's natural resource agencies have worked closely with the sponsors during the formulation of the work plan to select the alternatives which will best meet the needs of the people within the watershed and the people of the State of Maine.

This Work Plan has been reviewed and approved by the Maine Soil and Water Conservation Committee. As Governor, I hereby approve this Work Plan for the Fish Stream Watershed Project. I certainly hope this project can receive prompt authorization for construction.

Sincerely,

  
KENNETH M. CURTIS  
Governor

KMC:cm



WATERSHED WORK PLAN

FISH STREAM WATERSHED

Penobscot County, Maine

Prepared Under the Authority of the Watershed  
Protection and Flood Prevention Act (Public Law  
566, 83rd Congress, 68 Stat. 666), as amended.

Prepared by:

Southern Aroostook Soil and Water Conservation District

Town of Patten

U. S. DEPT. OF AGRICULTURE  
FLOOD PREVENTION DIVISION

JAN 26 1971

With assistance by:

U. S. Department of Agriculture, Soil Conservation Service

U. S. Department of Agriculture, Forest Service

Cooperative Extension Service, University of Maine

August 1969





ADDENDUM SHEET

Fish Stream Watershed

(Project Evaluation at 4-7/8% Interest)

COMPARISON OF BENEFITS AND COSTS

The ratio of average annual primary benefits (\$89,761) without the inclusion of local secondary benefits, to the estimated average annual costs (\$40,579) is 2.2:1.0. The total average annual benefits, including secondary benefits, are \$97,681. The benefit - cost ratio is 2.4:1.0.



WATERSHED WORK PLAN AGREEMENT

between the

Southern Aroostook Soil and Water Conservation District

Town of Patten

(hereinafter referred to as the "Sponsoring Local Organization")

State of Maine

and the

Soil Conservation Service  
United States Department of Agriculture

(hereinafter referred to as the "Service")

WHEREAS, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Fish Stream Watershed, State of Maine, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress; 68 Stat. 666), as amended; and

WHEREAS, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

WHEREAS, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Fish Stream Watershed, State of Maine, hereinafter referred to as the Watershed Work Plan, which plan is annexed to and made a part of this agreement;

NOW, THEREFORE, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about three years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions and stipulations provided for in the watershed work plan:

1. Except as hereinafter provided, the Sponsoring Local Organization will acquire without cost to the Federal Government such land rights as will be needed in connection with the works of improvement. (Estimated cost \$33,015.) The percentage of this cost to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (Percent)	<u>Service</u> (Percent)	<u>Estimated Land Rights Cost</u> (Dollars)
Multiple Purpose Site No. 1 and Recreation Facilities			
Payment to landowners for about 410 acres	50	50	13,255
Cost of relocation or modification of improvements	50	50	18,000
Legal fees, survey costs, flowage ease- ments and others	100	0	1,760

The Sponsoring Local Organization agrees that all land acquired or improved with PL-566 financial or credit assistance will not be sold or otherwise disposed of for the evaluated life of the project except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement.

2. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of works of improvement.

3. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization (Percent)</u>	<u>Service (Percent)</u>	<u>Estimated Construction Cost (Dollars)</u>
Multiple Purpose Site No. 1			
Joint Costs	14.06	85.94	414,456
Specific Costs (Clearing of Recreation Pool)	50	50	71,738
Recreational Facilities	50	50	90,700

4. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization (Percent)</u>	<u>Service (Percent)</u>	<u>Estimated Engineering Cost (Dollars)</u>
Multiple Purpose Site No. 1			
Joint Costs	0	100	50,000
Specific Costs (Clearing of Recreation Pool)	0	100	2,000
Recreational Facilities (A & E Contracts)	50	50	5,000

5. The Sponsoring Local Organization and the Service will each bear the costs of Project Administration which it incurs, estimated to be \$6,862 and \$25,448 respectively.

6. The Sponsoring Local Organization will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation plans on their land.

7. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

8. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

9. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

10. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

11. This agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

12. A watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

13. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

14. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. Sec. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving Federal financial assistance.

Southern Aroostook Soil and  
Water Conservation District

By /s/ Henry J. McBride

Title Chairman

Date September 3, 1969

The signing of this agreement was authorized by a resolution of the governing body of the Southern Aroostook Soil and Water Conservation District adopted at a meeting held on September 3, 1969.

/s/ Ora P. Mooers  
(Secretary)

Date September 3, 1969

\*

\*

\*

Town of Patten

By /s/ Robert L. Anderson

Title Chairman Bd Selectmen

Date September 2, 1969

The signing of this agreement was authorized by a resolution of the governing body of the Town of Patten adopted at a meeting held on September 2, 1969.

/s/ F. O. Smallwood, Dep.  
(Town Clerk)

Date September 2, 1969

\* \* \*

Soil Conservation Service  
United States Department of Agriculture

By \_\_\_\_\_  
(Administrator)

Date \_\_\_\_\_

\* \* \*





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## SECTION I

### WATERSHED WORK PLAN

#### Fish Stream Watershed

Penobscot County, Maine

August 1969

### SUMMARY OF PLAN

#### Participating Organizations

The Fish Stream Watershed Work Plan for watershed protection, flood prevention, and public recreation has been prepared by the Southern Aroostook Soil and Water Conservation District and the Town of Patten, the sponsoring local organization. Technical assistance was provided by the Soil Conservation Service and the Forest Service of the United States Department of Agriculture, and the Cooperative Extension Service of the University of Maine.

Other state and federal agencies consulted in the development of the work plan were: Maine Department of Inland Fisheries and Game, Maine Forest Service, Maine Water and Air Environmental Commission, Maine State Park and Recreation Commission, Maine Department of Economic Development, Maine State Highway Commission, Maine Public Utilities Commission, Maine Soil and Water Conservation Committee, United States Fish and Wildlife Service, Farmers Home Administration, Corps of Engineers, National Park Service, Bureau of Outdoor Recreation, Agricultural Conservation and Stabilization Service, Agricultural Research Service, Maine Department of Health and Welfare, Water Resources Center (University of Maine), and Maine Department of Agriculture.

#### Location and Size of Watershed

The Fish Stream Watershed is an area of 26.8 square miles (17,146 acres) located in Penobscot County, Maine. The watershed is within a region of moderately steep hills. The watershed is composed of two major tributaries, Fish Stream and Peasley Brook, which join above Route 11 and flow through the Town of Patten to the Aroostook County line and finally into the West Branch Mattawamkeag River. Patten is located about 96 miles north northeast of Bangor, Maine.

## Watershed Problems

The major problem in the watershed is floodwater damage to roads, bridges, railroads, residential property, and commercial and industrial establishments. Other problems that exist in the watershed are pollution in Fish Stream below the Route 11 bridge and in Webb Brook, and a lack of water-based community recreational facilities.

The Patten area was part of the Aroostook County Redevelopment Area as designated under the Area Redevelopment Act. The watershed was in an area temporarily designated as eligible for assistance under the more recently enacted Public Works and Economic Development Act of 1965.

## Major Floods of Record

Fish Stream has produced several damaging floods in recent years. Major floods of record occurred in 1923, 1954, 1962, and 1966. The flooding resulting from the intense rainfall of September 11, 1954, is considered the most destructive one of recent history. Floodwater damages caused by this storm were estimated to be \$82,840.

## Proposed Works of Improvement

This work plan provides for accelerating the installation of land treatment measures and the construction of one floodwater retarding structure, which will include beneficial storage for public recreational use. Water-based recreation facilities will also be developed. All measures will be installed within a three-year period.

The land treatment measures will provide means of improving the hydrologic characteristics of the watershed, which will reduce runoff from the watershed and stabilize sediment-producing areas where erosion is a problem. The floodwater retarding structure will control the runoff from 83 percent of the total drainage areas. The proposed measures will provide 100-year level of protection to the industrial and commercial establishments, residential properties, and public utilities in the Town of Patten.

The installation cost of the land treatment measures is estimated to be \$145,800, of which \$46,200 is for accelerated technical assistance. Public Law 566 funds will bear \$38,500 of this amount, and \$7,700 will be borne by other funds.

The estimated installation cost of the multiple purpose structure is \$570,057. Public Law 566 will bear \$459,103 of this amount of which \$15,052 is for land rights. Local funds will bear the remaining cost of \$110,954, of which \$16,813 is for land rights, and \$94,141 is for the local share of the construction costs of the multiple purpose structure.

The estimated installation cost of the recreational facilities is \$96,850. Public Law 566 funds will bear \$48,425 of this amount of which \$575 is for land rights. Local funds will bear the remaining cost of \$48,425, of which \$575 is for land rights, and \$47,850 is for the local share of the construction and engineering services cost of the recreational facilities.

The total estimated installation cost of both the land treatment and structural measures is \$845,017.

#### Project Benefits

The primary purpose of the project is to develop the water and related land resources of the Fish Stream Watershed for watershed protection, flood prevention, and water-based public recreation use. This project will improve the overall economic climate of the area and provide a stimulus for sound resource planning and development.

The proposed project will eliminate damages from a flood comparable in magnitude to the September 1954 flood and provide an estimated 98 percent reduction in average annual floodwater damages.

The average annual cost of the structural works of improvement included in the project is estimated to be \$38,896. The average annual benefits resulting from these works of improvement are estimated to be \$97,590. These benefits include secondary benefits of \$7,948, redevelopment benefits of \$8,609, recreation benefits of \$64,196, and flood prevention benefits of \$16,837.

The project has a benefit - cost ratio of 2.5:1.0.

#### Local Responsibilities

The local sponsors will pay their share of land rights and project administration costs, and operate and maintain structural works of improvement and the public recreational facilities. Their share of the land rights cost and the annual operation and maintenance cost is estimated to be \$17,388 and \$6,200 respectively. The sponsors will also provide the appropriate cost-sharing funds for the recreation water portion of multiple purpose site 1.

(A more detailed explanation of local responsibilities is shown under "Project Installation.")

The Town of Patten plans to use loan provisions of the Act administered by Farmers Home Administration to finance their share of installation costs.



## DESCRIPTION OF WATERSHED

### Physical Data

General: The Fish Stream Watershed, located in the northeastern part of Penobscot County, Maine, has a drainage area of 17,146 acres (26.8 square miles) to the Aroostook County line. Starting at the western edge of the township of Patten, Fish Stream flows in an easterly direction through the watershed and the village of Patten to the Aroostook County line and finally into the West Branch Mattawamkeag River just above the Town of Island Falls. Starting in the township of Mount Chase, Peasley Brook flows in a southeasterly direction through the watershed and into Fish Stream about 0.8 miles west of Route 11. The watershed is within a region of moderately steep hills. Elevations range from 1,110 feet on the northeastern divide to 500 feet at the Aroostook County line. The watershed is a portion of the Penobscot River Basin.

Geology: The Fish Stream Watershed lies within the New England physiographic province of the Appalachian Highlands. This region has been glaciated by at least the last major advance of continental glaciation. This Wisconsin age ice sheet has scoured the bedrock surface with the resulting loss of much weathered rock and residual soils. The present soils are derived from glacial drift (till and outwash) which was deposited during the last glacial age. Generally, these deposits are shallow and at the higher elevations in the watershed there are frequent exposures of bedrock.

Bedrock consists of Silurian aged, altered, grey and green siltstone, sandstone, slate, and conglomerate. The region has undergone varying degrees of metamorphism which has resulted in the alteration of the sedimentary rocks. Regional crustal deformation has folded and faulted these rocks to produce a complex northeasterly-oriented structural pattern. The rocks are part of the Weeksboro Lunksoos Lake Anticline, a structural pattern which extends from Mt. Katahdin to New Brunswick.

Fish Stream and its tributaries have eroded through the cover of glacial drift and are now stabilized on bedrock. Stream patterns in the watershed are primarily influenced by the southeasterly orientation of the major ridges. The orientation of these ridges coincides with the southeasterly flow of the continental ice sheet and is probably the result of molding by the ice.

Soils: The soils in the watershed are located on a succession of glacial till ridges and within the narrow interlying valleys. The sides of the ridges are gently sloping to moderately steep.

Three soils - Thorndike, Dixmont and Burnham occupy approximately 80 percent of the surface area of the watershed. The major soil of the upland is the Thorndike - a shallow soil 2 feet or less to nearly vertically bedded slate and sandstone. The Thorndike soil occupies about 40 percent of the watershed area.

Poorly and very poorly drained soils - Monarda and Burnham, occupy 25 percent of the area. These soils lie on the nearly level and slightly concave upland areas and are developed in deep slaty and shaly glacial till.

The Dixmont - a deep moderately well drained silty soil developed in slaty and shaly glacial till, occupies about 15 percent of the upland area of the watershed.

Silty soils such as the well drained Bangor and Perham, moderately well drained Daigle, very poorly drained Saco and the organic soils, peat and muck, comprise about 20 percent of the area. These soils are interspersed in the landscape with the three major soils as noted above and do not influence the area as a homogenous unit.

Nearly all of the surface soils are silt and clay or silty sand and gravel of low plasticity.

Water and Water Quality: Willey Pond, 44 acres in size, is the only sizeable body of water in the watershed. Stream gradients are steep in the upper portions of the watershed and become moderately steep in the lower portions.

According to the Maine Water and Air Environmental Improvement Commission's classification of fresh water, Fish Stream, main stem only, from its confluence with Crystal Stream Tributary to a point  $\frac{1}{4}$  mile upstream of the Route 11 bridge in Patten, and Webb Brook and its tributaries in the Town of Patten are classified as Class "C." The rest of Fish Stream and tributaries are classified as Class "B-1."

Class "B-1" water shall be acceptable for recreational purposes, including bathing, for use as potable water supply after adequate treatment and for a fish and wildlife habitat. Class "C" water shall be of such a quality as to be satisfactory for recreational boating and fishing, for fish and wildlife habitat and for other uses except potable water supplies and swimming, unless such waters are adequately treated.

Maintaining high quality water is extremely important and is essential to the future development of the Fish Stream Watershed. Every effort will be made to prevent contamination of the streams and, if possible, improve the quality of the water. In doing so, the water will be better suited for recreational, domestic, industrial and other uses.

Climate: The watershed has a modified continental-type climate with long, cold winters and mild summers. The normal growing season is 125 days running from May 21 to September 24. The average yearly precipitation is 41.7 inches which is distributed fairly uniformly throughout the year. Snowfall averages approximately 99 inches annually. The approximate average monthly temperature ranges from 16 degrees in January to 66 degrees in July.

Land Use and Cover Conditions: Present land use in the watershed is as follows: cropland and pasture - 4,007 acres; forest - 12,722 acres; and 417 acres in miscellaneous uses such as urban areas, ponds, streams, etc.

Approximately 74 percent (12,722 acres) of the watershed is in forest cover. It has been determined that 9 percent of the forest land is in poor hydrologic condition, 59 percent in fair condition, 23 percent in good condition, and 9 percent in very good hydrologic condition. With continued protection and more intensive management, most of the forest land should be in good hydrologic condition at the end of the evaluation period.

#### Economic Data

The watershed is located in Penobscot County and includes part of the townships of Patten and Mount Chase. Patten, the only town located within the watershed, was incorporated in 1841. The population was 470 in 1850 and 1,312 in 1960. The population in the watershed area has been decreasing slightly over the past twenty years.

The economy of the watershed is based on farming, lumbering and pulp cutting, wood products industries, and some recreational enterprises. Farming operations are mainly potato growing and dairy farming. A large part of the potato crop is raised for seed potatoes.

The number of farming units has been decreasing and the size of farm has been increasing in the watershed area. However, about 90 percent of the farms in the watershed are family farms.

Low-income producing units comprise about 35 percent of the farms in the watershed. There are presently no farming operations in flood plain areas.

The major industry in the Town of Patten is the J. M. Huber Corporation, manufacturers of veneer, plywood, and other wood products, which is located in the flood plain of Fish Stream. This firm employs about 85 workers and has a major effect on the economic well-being of the watershed.

The Town of Patten is located on the edge of Baxter State Park, and as such is a natural base of operations for the tourist and sportsman.

Sporting camps and lodges are the main types of recreational enterprise in the area. They cater to the hunter, fisherman, hiker, and outdoor enthusiast.

There is no Federal or state land in the watershed.



There are approximately 100 landowners in the watershed. Of these about 40 are engaged in farming, wholly or partially within the watershed. The average size of farm is about 225 acres. According to the 1964 Census of Agriculture, the average value of land and buildings per farm is \$17,700 in Penobscot County. The average value per acre of cropland is about \$200 and the average value per acre of woodland is about \$20.

Patten is accessible by Federal, state, and town highways. Interstate 95, which was just completed in the Fall of 1967, passes within 10 miles of Patten. A network of rural roads serves the farms and woodlots in the watershed. Patten has no commercial air transportation facilities; however two flying services are operated on Shin Pond, about 10 miles from Patten. Passenger service is provided by the Bangor and Aroostook Railroad Company Bus Line to Island Falls, about 10 miles from Patten. Railroad freight service is provided for the watershed area.

Present forest stands occupying 74 percent of the watershed consist of 55 percent softwoods (mainly spruce-fir) and 45 percent hardwoods, primarily maple-beech-birch. About 9 percent of the forest stands are sawtimber size, 68 percent pole size, and 23 percent seedling-sapling size. All forest land is privately owned.

Adequate forest fire protection is provided by the Maine Forest Service in cooperation with the U.S. Forest Service through the Clarke-McNary Cooperative Fire Control Program. Other current Federal-state forestry programs include Cooperative Forest Management, Cooperative Forestation, and Cooperative Insect and Disease Control. Given protection, care and management, the forest stands are expected to increase their contribution to the economy of the watershed.

An excellent demand exists for quality veneer hardwood sawtimber. There is a good demand for both hardwood and softwood sawtimber. Pulpwood markets are fair. A demand also exists for cedar fencing, cabin stock and hardwood furniture squares.

The watershed program will help promote rural community development. The watershed is within the St. John-Aroostook Resource Conservation and Development Project Area.

#### Land Treatment Data

The Southern Aroostook Soil and Water Conservation District was organized in 1942. There are 941,000 acres in the District, with less than 15 percent in crops and pasture. The major problems in the District are control of surface runoff and drainage. Through the use of diversions, waterways, tile drainage systems, and other land treatment measures, the District is assisting landowners in solving these problems. Presently, about 40 percent of planned conservation practices are applied. There are 34 district cooperators in the watershed and 27 basic plans have been completed.

About 42 percent of the land in the watershed is under cooperative agreement. Providing assistance to low-income producing units has been given a high priority by the Southern Aroostook Soil and Water Conservation District.

The trend in the watershed during recent years has been toward larger farm units and changing land use. Smaller farm units are being combined into large, single farm units. Much of the cropland is being converted to other uses such as recreation, wildlife, etc. The district is providing assistance to landowners, towns, and municipalities in resource planning and development. The district recognizes that an increasing amount of their effort should be directed toward non-agricultural soil and water conservation problems, and they are proceeding in this direction.

#### Fish and Wildlife Resource Data

Fish Stream currently supports a fairly good brook trout fishery which is maintained by natural reproduction. In addition to brook trout, the stream also supports populations of eel, yellow perch, pumpkinseed sunfish, Three-spine stickleback, and minnows. The stream grade is moderate and the topography provides adequate holding pools and riffles. There is a considerable amount of spawning and nursery area for trout in the tributaries to the main stream. The movement of fish is presently impeded by a dam located at the factory below Route 11. Fishing pressure is light to moderate.

The principal wildlife species in the area are deer, black bear, moose, ruffed grouse, snowshoe hare, woodcock, mink, otter, muskrat, and beaver. No deer yards are located in the area to be flooded but deer do yard in the watershed. Hunting opportunities are excellent and the Patten area is recognized as one of the State's better big-game hunting areas.

Waterfowl are of minor importance due to the absence of good quality habitat.

### WATERSHED PROBLEMS

#### Floodwater Damage

Fish Stream has produced several damaging floods in recent years. The major floods of record occurred in 1923, 1954, 1962 and 1966. The flooding resulting from the intense rainfall of September 11, 1954, is considered the most destructive one of recent history. Floodwater damages caused by this storm were estimated to be \$82,840, and it was estimated to be a 45-year frequency storm.



Road and bridge damage caused by flood of April, 1923.



Lumber carried by floodwater during September, 1954 storm and deposited near railroad washout.



Eleven residences, three industrial and commercial establishments, nine potato storage houses, two bridges, several roads and sections of railroads, and some public property are subject to floodwater damage as the result of a 100-year frequency storm in the watershed. A storm similar to the one in September 1954 would damage eight residences, two industrial and commercial establishments, seven potato storage houses, two bridges, several roads and sections of railroad, and some public property.

Nearly every year during the period of spring snowmelt, several basements of residences are flooded and high water results in the shutdown of the major industry in the Town of Patten for a few days.

The potato storage houses are subject to flooding from storms of about a five-year frequency or above. When potatoes in storage are flooded, problems of shipping potatoes early, increased rot and bruise, and selling at reduced prices are encountered. Additional expenses for protective measures are also incurred, as well as damages to the buildings. Average annual damages to potato storage houses are estimated to be \$1,374.

Urban property is subject to major damage from storms of about a ten-year frequency and above. Average annual damages are estimated to be \$7,710.



Washout of Railroad of the J. M. Huber Corp. during the flood of November, 1966.

Damage to roads and bridges begins at about a ten-year frequency storm. Average annual damages are estimated to be \$2,964.

Damage to railroads begins at about a five-year frequency storm. Average annual damages are estimated to be \$422.

Indirect damages are estimated to be \$2,064 annually. Total average annual floodwater damage in the watershed is estimated to be \$14,534.

Sewage is presently discharged into the stream from residential, industrial, and commercial sources. During periods of flooding this creates a health problem.

The fishery resource in Fish Stream and its tributaries is predominantly brook trout. Floods cause stream scouring, bank erosion, and sediment in the streams which have a detrimental effect on the brook trout fishery.

#### Sediment and Erosion Damage

The watershed is about 74 percent forest, 23 percent cropland and grassland, and 3 percent urban. A high percentage of the cropland is in permanent hay and pasture. The vegetative cover condition of the watershed is good to excellent. There is no agricultural land in the floodplain and very little in the watershed which contributes any significant amounts of damaging sediment to the waterways.

The urban area of Patten is the major source of stream sediment; contribution is made by roadbanks, road cuts, and unstabilized stream channels. There are no localized critical erosional upland areas.

#### Problems Relating to Water Management

The Town of Patten presently obtains its water supply from springs and drilled wells. An adequate supply of water is available for the present and immediate future. Long-range planning may require the development of an additional supply. The proposed project will not prevent development of or utilize needed future sites for water.

There is a considerable amount of pollution in Fish Stream. Sewage is now discharged into the stream below the proposed site from residential, industrial, and commercial sources. This is not only a real nuisance problem to the people in the town, but is detrimental to the stream fishery and destroys the water resource for other uses. Fish Stream is Class B-1 quality above the structure site. The present water quality is adequate for recreational purposes.

The Town of Patten does not have a water-based recreational facility within walking distance of the village. The nearest sizeable body of water is about 10 miles away. Baxter State Park is about 20 miles from Patten. The population within a 20-mile radius is about 7,100, and the projected population in the year 2000 is about 9,800. The population within a 50-mile radius is about 65,000, and the projected population in the year 2000 is about 89,100.

The local people are interested in developing a community recreation area for swimming, picnicking, boating, etc., and have requested that a recreational lake be included in the project.

#### PROJECTS OF OTHER AGENCIES

The works of improvement included in this work plan would be an integral part of a coordinated development for the Penobscot River Basin. Work on the Fish Stream Watershed would have no adverse effect on any existing or proposed downstream projects.

#### PROJECT FORMULATION

Frequent flooding of Fish Stream has resulted in extensive damages to industrial and commercial establishments, potato storage buildings, roads, bridges, railroads, and residences and has created problems for property owners, business establishments, railroad officials and local and state highway officials. It is, therefore, of major concern to people living in this area that they have adequate protection to both life and property from such floodwater damages as produced by the floods of 1923, 1954, 1962, and 1966.

The principal objectives, as set forth by the local sponsors in formulating the project are:

1. To provide the people living and working in the watershed a 100-year level of flood protection to residential, industrial and commercial property, roads, railroads, and other public property.
2. To reduce sediment damage to local people and increase the natural value of land and water through the use of a good land treatment program.
3. To provide local people, particularly low-income families, with water-based recreational opportunities through the development of water storage and recreational facilities for public use.

The sponsors feel strongly that the accomplishment of these objectives will create a better environment for people living in the area. The sponsors also believe that the installation of works of improvement will serve as a stimulus to economic growth and activity in the area, such as providing local employment and more business activity.

Land treatment measures outlined in this plan complement the structural works of improvement by contributing to the project objectives of reduced runoff, erosion, and resource development. There are approximately 7,244 acres of cropland, grassland and forest land in the watershed that need treatment. About 30 percent of this land will be adequately treated during the installation period. The application of these measures, in addition to improving the quality of agricultural and forestry products, will enhance the project by extending the useful life of the proposed structure through reduced sedimentation.

Agreement has been reached by the sponsoring local organizations that one of the objectives of the land treatment program in this watershed should be the improvement of low farm incomes. The sponsors recognize the importance of having a complete land treatment program and intend to make a concerted effort toward making the watershed an outstanding example of soil and water conservation.

The structural measure selected for this plan is a multiple-purpose floodwater retarding and recreational structure with an adjacent public recreation development.

Various combinations of release rates, storage volumes, dam heights, and emergency spillway widths were studied in order to determine the most effective combination for minimizing structure costs and, at the same time, maintaining a satisfactory level of protection against downstream flooding.

Site 1 has been designed as a multiple-purpose structure. A permanent pool of about 183 acres will be maintained for recreational and fish and wildlife purposes. The narrow arm of the pool on the Fish Stream tributary will be utilized exclusively for fish and wildlife purposes. This is a water area of about 31 acres. A high quality day use recreational facility will be installed on the north side of the lake.

The Town of Patten will prepare a development plan for the lake area and implement zoning to direct its use and development so as to yield the greatest benefits to all the people in the community.

The local people have actively participated in formulating the various aspects of this project.

#### WORKS OF IMPROVEMENT TO BE INSTALLED

##### Land Treatment Measures

Land use will be within the capabilities of the land, and treatment will be in accordance with needs and objectives to be accomplished. The combinations and alternative land treatment measures planned for the 1,061 acres of cropland to be treated include conservation cropping systems, contour farming, diversions, cover and green



manure crops, farm ponds, obstruction removal, grassed waterways, and tile drains. The combinations and alternative land treatment measures planned for the 450 acres of grassland to be treated include pasture and hayland management, brush control, wildlife habitat development, pasture and hayland renovation, and farm ponds. The purpose of land treatment is to provide protection to the land, which is presently subject to erosion and other problems, rather than to bring additional land into agricultural production. The physical characteristics of the soil also will be improved, thus providing for greater infiltration and percolation rates, increasing water storage capacity, and reducing runoff. These measures complement the structural works of improvement and help to bring about the realization of the project objectives and assure project benefits.

Land treatment was considered the first increment in project formulation. Estimates of the land treatment to be installed during the three-year installation period were based on land treatment needs and actual accomplishments to date. Land treatment on cropland and grassland will be applied by landowners with technical assistance from the Soil Conservation Service under cost-sharing arrangements with the Agricultural Stabilization and Conservation Service.

The land treatment practices for the three-year installation period are accelerated beyond the normal goals in order to meet the needs of a sound watershed protection program. This involves approximately three and one-half man years of additional technical assistance which will be financed from PL-566 funds. The scheduling of land treatment will be spread evenly over the installation period. No time is included for accelerating the soil surveys, since this job is complete within the watershed. Surplus crops are not involved in the agricultural production of this watershed.

#### Forest Land Measures

The following remedial program has been developed from a statement of land treatment needs prepared by the Maine Forest Service and the U.S. Forest Service. Land treatment needs were determined by a field survey of the watershed.

##### A. Tree Planting - 24 acres

Reforestation of appropriate open lands is necessary to adjust land use with capability and reduce runoff and erosion by developing a protective cover and an abundant forest floor "sponge" of litter and humus.



B. Hydrologic Cultural Operations - 129 acres

These silvicultural operations are aimed at improving hydrologic condition by manipulation of stand composition to create conditions favorable for the maximum protection and production of litter, humus, and forest cover. They include thinnings, weedings, improvement, salvage and harvest cuttings.

C. Skid Trails and Logging Road Erosion Control - 2.0 miles, 80 acres

This measure will reduce runoff, erosion, and sedimentation by diverting water from eroding skid trails and logging roads. Simple water breaks (ditches with pole or earthen diversions) spaced at specific intervals are the usual means of controlling or diverting water. Stabilization is further attained by planting shrubs or trees and sowing native grasses.

D. Technical Assistance

The watershed forest land must be brought into and maintained in the best hydrologic condition possible dependent on soil and site characteristics. Technical assistance aimed at accomplishing this objective is needed for installing the measures on this land. It involves (a) stimulation of landowner interest and participation in the watershed program; (b) general planning, supervision and inspection of the land treatment phase of the program; and (c) assistance to individual landowners in installing the forestry measures on their land. In order to determine the watershed needs and to properly program the installation of forestry measures on privately-owned land, individual management plans will be prepared for 39 forest landowners, involving 5,500 acres. These plans will describe forest land treatment measures to be accomplished during the three-year installation period.

Structural Measures

Structural measures planned consist of one multiple-purpose floodwater retarding structure and associated public recreational facilities.

This single structure will control 83 percent of the watershed drainage area. (See project map for location of structure and recreational development.)

The structure will provide 4,191 acre feet of floodwater detention storage, 136 acre feet of sediment storage, and 1,693 acre feet of storage for recreational use.

Tables 2 and 3 contain a summary of costs and physical details. An explanation of pertinent details for the site is given below:

Site 1 (Fish Stream) - This site is located on Fish Stream about 1,700 feet upstream from the Route 11 bridge in Patten. The structure will control 22.26 square miles of drainage area, and provide temporary floodwater storage for 3.53 inches of runoff. The geophysical surveys indicate that the foundation material consists of an unconsolidated material over bedrock. The left abutment is comprised of approximately 10 feet of cobbly, silty gravel (washed till) over bedrock. The foundation material on the right abutment and principal spillway area consists of an insignificant amount of washed till and outwash, generally less than two feet, over shallow to exposed bedrock. The rock surface is weathered and somewhat irregular; however, the rock is erosion resistant and provides a non-yielding foundation condition. The principal spillway is designed as a single-stage riser with a 54-inch diameter reinforced concrete outlet conduit and a plunge pool excavated in bedrock. Directly below the plunge pool a channel will be shaped and extended through the disturbed bed area to natural shade so that a 4-foot depth of water will be provided for fish habitat. This will prevent rapid warming of the discharge water and harmful effects on the downstream trout fishery. The principal spillway system will have an average release rate of 480 cubic feet per second and a peak discharge of 592 cubic feet per second and will regulate the flow up to and including the 100-year frequency storm. The estimated drawdown time of the 100-year frequency flood pool is seven days. A 100-foot wide emergency spillway will be constructed around the right abutment. It will be constructed in rock and requires approximately 2,300 cubic yards of rock excavation and 2,600 cubic yards of earth excavation. The dam will be constructed of approximately 338,000 cubic yards of compacted earth fill and will be about 70 feet high. An adequate source of borrow is available approximately 3,000 feet south of the centerline in open fields. A backhoe investigation and laboratory analysis showed the fill material to be a silty or clayey gravelly sand (SM). Sediment storage consists of 117 acre feet in the permanent pool and 19 acre feet aerated in the flood pool.

In addition to flood and sediment storage, the structure will impound 1,693 acre feet of recreational water for the Town of Patten. This results in a permanent pool of 168 acres, having a maximum depth of 37 feet. The clearing of the southwest arm of the pool (31 acres) will be modified to leave stumps at a height of 3 or 4 feet above the permanent pool to curtail boat traffic and create additional waterfowl habitat. The remainder of the permanent pool (137 acres) will be cleared within 12 inches of the natural ground.

Unlimited public access will be assured by acquiring all land within the taking line (see Public Recreational Development map).

The total installation cost of the structure and clearing of the recreation pool is estimated to be \$570,057, of which \$110,954 will be borne by local funds.

Public Recreational Facilities - The public recreational facilities will be located on the north shore of the pool away from the wildlife area. The facilities will be installed on 45 acres of land and consist of swimming, picnicking, boating, and nature study.

The water supply system will include approximately 3 drinking fountains and 3 water taps in the picnic area plus a drinking fountain and water tap on the outside of the bathhouse.

Toilet facilities include 9 water closets and 4 urinals.

The beach development includes the placement of sand 18 inches deep over an area of 2,000 square feet.

A coin-operated gate will be installed on the main entrance road, and a gate will be installed at the east end of the picnic-swimming parking area to discourage users from driving through the picnic area.

All planned facility installations will be operated and maintained to meet the requirements of state and local health regulations. (See Table 2B for details of recreational facilities.)

The estimated installation cost of the recreational facilities is \$96,850, of which \$48,425 will be borne by local funds.

Approximately 428 acres will be needed for the water resource improvement, of which 365 acres will be acquired in fee title and 63 acres by flowage easement. An additional 45 acres will be acquired in fee title for the recreational facilities.

The total cost of structural measures is estimated to be \$699,217, of which \$166,241 will be borne by local funds.

#### EXPLANATION OF INSTALLATION COST

The unit costs for installation of openland treatment measures were based on costs experienced in the Southern Aroostook Soil and Water Conservation District. They include the cost of farm labor, equipment, and materials such as tile, fertilizer and seed.

Workload analysis data were used for estimating the cost of technical assistance needed in applying the practices. The workload analysis was also used in making a determination as to the amount of additional technical Public Law 566 funds required for accelerating planning and installation of land treatment measure, in addition to that amount provided by other programs.

Costs for the installation of forest land treatment measures are based on current costs of supervision, labor, equipment and materials needed to perform the particular measures.

Costs of technical assistance for the installation of forest land treatment measures are based on actual expenditures and accomplishments of the Maine Forest Service. An analysis of costs against accomplishments was made for each measure to determine unit costs for technical assistance.

Cost computations for the structural measures were made at 1968 prices based on calculated quantities and estimated unit costs for construction items. These estimates were obtained from bid prices for structures of a similar type constructed in Maine. A contingency allowance of 12 percent was added to the engineer's estimate.

Estimated unit prices were obtained from a concrete pipe company on the strength and size conduit required at the site. These prices were adjusted to reflect transportation costs and conditions at the site. Compacted earth fill costs were based on \$.75 per cubic yard. Several factors which influenced the cost of fill at the site were the haul distance, quantity of fill, and securing the borrow area outside of the site. Unit costs for reinforced concrete, including the reinforcing steel were estimated at \$100 per cubic yard. Earth excavation cost was based on \$1.00 per cubic yard. Rock excavation was estimated at \$10.00 per cubic yard. Clearing was estimated at \$350 per acre and grubbing at \$650 per acre. Fertilization and seeding of the earth embankment emergency spillway, and borrow areas was based on a cost of \$600 per acre.

Cost computations for the recreational facilities were made at 1968 prices based on bid prices of similar facilities constructed in Maine and other northeastern States. Soil suitability ratings were considered in determining costs of the recreational development. Guidelines for design are outlined in the basic engineering file.

Engineering services include surveys, geologic investigations, design and preparation of plans and specifications. Additional detailed geologic investigations will include backhoe test pits, drilling of the site and laboratory testing of soil samples. Geologic investigation costs were based on recent unit costs for similar work in Maine. Costs for engineering services were based on the installation of structures of comparable size in other projects located in the northeastern States. Engineering services on structural measures included in this plan range from 5.5 to 10.7 percent of construction costs.



Land rights cost estimates were obtained by consulting the sponsors. They evaluated the land involved at the site using real estate values which were considered representative of this area. The total land rights cost reflects estimated cost of \$4,000 for the relocation of a utility line and \$14,000 for raising State Highway Route 159 to elevation 593, and enlarging the bridge. The cost estimates on the highway and bridge were furnished by the State Highway Commission.

Project administration costs were based on costs used in previous projects for similar type works of improvement. This includes cost of construction inspection, contract administration and government representatives.

The cost of the multiple-purpose site was allocated by the "use of facilities" method.

The installation cost is allocated as 71.88 percent flood prevention and 28.12 percent recreation. All costs were considered joint costs, except clearing costs, which were considered a specific cost to recreation. Joint costs are \$496,321, of which \$421,235 are PL-566 costs, and \$75,086 are local costs. Specific costs are \$73,736, of which \$37,868 are PL-566 costs, and \$35,868 are local costs.

Costs of land rights on land to be acquired for the Public Recreational Development (within the taking line) will be shared 50 percent by Public Law 566 funds and 50 percent by local funds.

The cost of flowage easements will be borne 100 percent by local funds. The recreational facility cost will be shared at the rate of 50 percent Public Law 566 funds and 50 percent local funds. Public Law 566 costs are \$48,425 and the remaining \$48,425 will be borne by local funds.

The estimated obligation of total project funds, both land treatment and structural measures, for each fiscal year during the installation period is as follows:

Fiscal Year	Measure	PL-566 Funds	Other Funds	Total
First	Site 1 - Fish Stream	\$ 53,368	\$ 43,868	\$ 97,236
	Land Treatment	12,833	35,766	48,599
Second	Site 1 - Fish Stream	425,735	73,086	498,821
	Land Treatment	12,833	35,767	48,600
Third	Recreation Facilities	53,873	49,287	103,160
	Land Treatment	12,834	35,767	48,601
T O T A L		\$571,476	\$273,541	\$845,017

## EFFECTS OF WORKS OF IMPROVEMENT

The combined program of land treatment and structural measures will have a pronounced effect in alleviating future floodwater, sediment, and erosion damages. Significant damage now occurs about once every five years. The project will provide complete protection from a recurrence of the September 1954 flood and a 100-year level of protection to potato storage facilities, roads, bridges, railroads, residences, and commercial and industrial property in all reaches. It is estimated that 50 property owners will be directly benefited by the project. Eleven residences and three commercial and industrial establishments will be directly benefited by the project.

In the area of the J. M. Huber Corporation, the 100-year discharge will be reduced from 3,990 cubic feet per second to 580 cubic feet per second, and the 10-year discharge will be reduced from 1,810 cubic feet per second to 450 cubic feet per second. The 100-year flood stage will be reduced about seven feet in this area.

With the project installed, total annual floodwater and sediment damages will be reduced by 98 percent. Damages to potato storage houses will be reduced by 99 percent, and damages to urban property will be reduced by 97 percent. Damages to roads, bridges, and railroads, will be completely eliminated.

The downstream area inundated by a 100-year flood is about 45 acres under present conditions and will be about 20 acres with the project installed, resulting in a direct benefit to 25 acres.

The bridge across Route 11, just below the structure, can be replaced with a much smaller one due to the reduction of the 100-year peak discharge from 3,990 cubic feet per second to 580 cubic feet per second, as a result of the works of improvement upstream.

Multiple-purpose site 1 will provide recreationally opportunities for boating, fishing, picnicking, swimming, nature study, winter sports, and other activities. The daily design capacity for the recreation facilities provided are as follows: swimming - 272, picnicking - 310, boat launching and parking - 240, playground - 84, and the nature trail - 40. The greatest amount of use is expected to occur during the summer recreation season - Memorial Day through Labor Day; however, some use is expected year around. Peak daily use is estimated to be 946, and average annual use is estimated to be 47,300. A value of \$1.50 per visitor day was used.

Recreational opportunities will be enjoyed by all the people in the watershed and particularly by low-income families. People with low income generally cannot afford private camps and many of the other types and means of water-based outdoor recreation.

The recreation permanent pool will provide opportunities for residential and summer cottage development along the shoreline on land outside the recreational development. This will increase land

values and provide additional tax revenue to the Town of Patten. All types of development around the lake will be carefully planned in accordance with the Town of Patten's zoning plan. This will protect the landowners and the community from haphazard and careless development, provide for a quality environment, and protect the water resources from pollution.

The construction of multiple-purpose site 1 will inundate some small game and upland fur-animal habitat. On the west arm of the reservoir a 31-acre marsh will be created. This area will attract aquatic fur animals as well as waterfowl, thus off-setting the reduction in small game and upland fur-animal populations.

The permanent pool in multiple-purpose site 1 will support trout; however, supplemental stocking will probably be necessary in order to maintain a desirable fish population. The releases through the principal spillway and toe drains, together with the increased channel depth, will help maintain low water temperatures downstream during the summer.

The reduced threat of flooding attained by the works of improvement is expected to bring about a considerable improvement and development of business, industry, residences, and transportation facilities. Reduction of flooding in various areas and the degree of protection at significant locations can be determined from the plan-profile included in the appendix of this plan. Potential sites for industrial, commercial, and residential development will be made available in areas receiving 100-year protection. Areas within the 100-year "with" project floodline are not provided sufficient protection for these uses. Future development in these areas should not be permitted.

The installation of land treatment measures will reduce sediment yields thus improving water quality and reducing maintenance costs on highway ditches and other drainage systems. These measures will increase the water storage capacity of the soils and reduce runoff on the watershed.

The installation, operation, and maintenance of works of improvement will provide employment opportunities for unemployed and under-employed labor and utilize other resources in the watershed area. The project will increase the level of economic activity in the watershed and provide the impetus for sound resource planning and development.

#### PROJECT BENEFITS

The combined program of land treatment and structural measures reduces the estimated average annual monetary floodwater damage from \$14,534 to \$284, a reduction of \$14,250 (98.0 percent).

Approximately 96.7 percent (\$13,780) of the reduction in average annual damage will result from the system of structural measures, with the remaining 3.3 percent (\$470) resulting from land treatment measures.

Indirect benefits attributable to structure were estimated to be \$2,024. These benefits were based on loss of wages, rerouting of traffic, and loss of income by businesses and inhabitants in the watershed.

Changed land use (urban) benefits in the watershed were based on the expected net income from rental of potato storage facilities. These estimates were based on data furnished by local people and current trends in the area. Benefits were estimated to be \$3,057 annually.

Recreation benefits were based on the expected amount of visitor days of recreation use on multiple-purpose site 1 - recreational development. It was estimated that 47,300 visitor days per year, with a value of \$1.50 for each visitor day, would be the average recreational use over the project evaluation period. These estimates were based on expected boating, nature walking, picnicking, and swimming use. The resulting benefits were lagged for five years. The estimated recreation benefit is \$64,196 annually.

Redevelopment benefits were estimated to be \$8,609 annually. These benefits were based on the expected job opportunities to be created for unemployed and underemployed local labor during the installation and operation and maintenance of project works of improvement.

Secondary benefits were estimated to be \$7,948 annually. These benefits were based on local secondary benefits stemming from the project such as the transportation, processing, and marketing of those goods and services that produce the primary benefits. Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation and therefore were not evaluated.

The proposed forest land treatment measures will improve the hydrologic condition of the forest land. This will have the effect of a reduction in sediment and the retarding of storm runoff. Also, proper management and continued fire protection will increase the productivity of the forest land on the watershed.

It is expected that the project will provide increased economic opportunities for low-income families, improve the overall economic climate of the area, and provide a stimulus for sound resource planning and development in the watershed area. In addition, there are other unevaluated benefits that will follow the installation of works of improvement such as a greater sense of security, a diminishing hazard to life from floods, and increased aesthetic values.



## COMPARISON OF BENEFITS AND COSTS

The ratio of average annual primary benefits (\$89,642) without the inclusion of local secondary benefits, to the estimated average annual costs (\$38,896) is 2.3:1.0. The total average annual benefits, including secondary benefits, are \$97,590. The benefit-cost ratio is 2.5:1.0. Table 6 shows a comparison of annual costs to annual benefits.

## PROJECT INSTALLATION

The land treatment and structural measures proposed in this plan are to be installed during a three-year installation period. The land treatment measures will be installed fairly uniformly over the period 1971 through 1973. Site 1 is planned to be installed in 1972 and the recreational facilities in 1973.

Federal assistance for carrying out the works of improvement as described in the work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act, Public Law 566, as amended.

The land treatment measures will be installed by landowners and operators with assistance from other going programs in cooperation with the Southern Aroostook Soil and Water Conservation District. Provision for carrying out the accelerated program will be included in the annual plan of the Soil and Water Conservation District Board of Supervisors.

The Agricultural Stabilization Conservation Committee will assist landowners in the watershed area in establishing conservation practices on the land through their program of cost sharing. This agency will advise the Soil and Water Conservation Districts as to the availability of funds in accordance to needs during the operations stage.

The Soil Conservation Service will provide technical assistance for the installation of openland treatment measures. The forest land treatment measures will be installed by the landowners with technical assistance furnished by the Maine Forest Service in cooperation with the U.S. Forest Service.

The Soil Conservation Service will furnish technical assistance for layout and design, preparation of plans and specifications, supervision of installations, and will provide cost sharing assistance as set forth in the Watershed Work Plan Agreement. The recreational facilities will be installed by A & E contract.

The Southern Aroostook Soil and Water Conservation District will be responsible for the following:

1. Assume local responsibilities in coordinating the activities of the various cooperating agencies in order to use all available resources to carry out the plan.
2. Take the leadership in developing an accelerated program of land treatment as set forth in the work plan.
3. Render available assistance to the Town of Patten in obtaining land rights.
4. Provide the necessary legal, administrative and clerical personnel, facilities, supplies and equipment to advertise, award and administer contracts on all structural works of improvement.

The Town of Patten will be responsible for the following:

1. Acquire by purchase or other means, land, easements, and rights-of-way and assure unlimited public access to multiple-purpose site 1 and the public recreational development. This total cost including both PL-566 funds and other funds is estimated to be \$33,015.
2. Share 50 percent of the construction cost of structure site 1 allocated to recreation as set forth in the Watershed Work Plan Agreement.
3. Share 50 percent of the construction cost and 50 percent of the engineering services cost of the public recreational facilities.

Based on their knowledge of the landowners involved in the sites, the local sponsors do not anticipate any difficulty in obtaining all necessary land rights.

The sponsors will exercise the power of eminent domain, where necessary, in securing land rights for land within their jurisdiction.

#### FINANCING PROJECT INSTALLATION

The Southern Aroostook Soil and Water Conservation District will administer contracts on all works of improvement through the use of state appropriated funds made available through the Maine Soil and Water Conservation Committee.

The Town of Patten will acquire all necessary land rights on site 1. The total estimated cost of land rights is \$33,015, of which \$15,627 will be borne by Public Law 566 funds, and \$17,388 will be borne by local funds.

The Town of Patten proposes to use loan provisions of the Act administered by Farmers Home Administration to finance their share of the installation costs including land acquisition for about 410 acres. They have filed a letter of intent with the State Director of Farmers Home Administration.

Public Law 566 funds will be used for structural measures during the installation period pursuant to the following conditions:

1. The sponsoring local organization has obtained agreements to carry out recommended soil conservation measures and proper conservation plans from owners of not less than 50 percent of the lands situated in the drainage area above the structure.
2. The sponsors have provided assurance to the State Conservationist in writing that they have legal authority, sufficient funds, and are willing and able to obtain all land rights for structural works of improvement.
3. The contracting agency is prepared to discharge its responsibilities.
4. Project agreements and operation and maintenance agreements have been executed.
5. Public Law 566 funds are available.

The total installation cost of the structural works of improvement is estimated to be \$699,217, of which \$166,241 will be borne by other than Public Law 566 funds.

The total cost of installing the openland treatment measures is estimated to be \$136,400. The installation cost will be borne locally. Technical assistance estimated at \$39,900 will be financed by \$35,800 of Public Law 566 funds, and \$4,100 of Public Law 46 funds.

The total cost of installing forest land treatment measures is estimated to be \$9,400. Technical assistance to private landowners for the installation of forestry measures will cost \$6,300 and will be provided for by the PL-566 program (\$2,700), the Maine Forest Service (\$500), and the Cooperative Forest Management Program (\$3,100).

The installation cost to private forest landowners is \$3,100.

It is expected that the Agricultural Conservation Program cost sharing will be available to qualified landowners for installing these measures.

The sharing of costs between PL-566 and all other sources of funds is shown in Table 1.

## PROVISIONS FOR OPERATION AND MAINTENANCE

### Land Treatment

Openland treatment measures will be maintained by landowners and operators on farms where such measures are installed. These measures are provided for in the owner's or operator's conservation plan under agreement with the Southern Aroostook Soil and Water Conservation District with technical assistance furnished by the U.S. Soil Conservation Service.

The forest land treatment measures will be maintained by the landowners with technical assistance furnished by the Maine Forest Service in cooperation with the U.S. Forest Service under the going CFM Forestry Program.

### Structural Measures

Multiple-purpose structure site 1, and the public recreational area will be operated and maintained by the Town of Patten.

The above-mentioned sponsors have the legal authority under State law to operate and maintain works of improvement as proposed in this plan.

All structural works of improvement will be inspected at least annually and after every major storm or the occurrence of any unusual adverse conditions that affect their operation. Items of inspection of each structure will include, but not be limited to, the condition of the principal spillway and its appurtenances, the emergency spillway, and fences and gates installed as part of the structure.

The inspection will involve representatives of the Town of Patten, the Southern Aroostook Soil and Water Conservation District, and the Soil Conservation Service.

These inspections will continue for three years following installation of the structure. Inspections after the third year will be made annually by the sponsors. They will prepare a report and send a copy to the Soil Conservation Service.

Inspection of the basic recreation facilities will be carried out at least annually until such time as the State Conservationist determines that further Service participation on this basis is no longer necessary.

Maintenance work likely to be required consists of keeping the principal spillways and appurtenances free of trash and maintaining proper vegetation on all earth structures. Operation and maintenance includes such major repairs and replacements as are necessary to keep the project functioning as planned.



The annual operation and maintenance cost for the structural measures is estimated to be \$6,200. This consists of \$5,200 for the public recreational area, and \$1,000 for site 1. The operation and maintenance cost of the public recreation area reflects replacement costs of the recreation facilities. The recreational development will be operated and maintained in accordance with State and local health laws and regulations.

Financing for the multiple-purpose development will be accomplished through taxation and admission fees for the recreation facilities. The admission fees will be limited to that needed to amortize the initial investment and to provide funds for adequate operation and maintenance. Items included, but not limited to, are custodial, policing, sanitation, and replacement of recreational facilities when needed.

Specific operation and maintenance agreements must be executed prior to the signing of the project agreement, which is the fund-authorizing document for each contract. The operation and maintenance agreement is an agreement entered into by the Soil Conservation Service and those sponsors who assume full responsibility for providing adequate and sound arrangements for proper operation, timely inspection, and prompt and appropriate performance of needed maintenance.



TABLE 1 - ESTIMATED PROJECT INSTALLATION COSTS

## Fish Stream Watershed, Maine

Installation Cost Item	Unit	Number Non-Fed. Land	Estimated Cost - (Dollars) <u>1/</u>		
			PL-566 Funds Non-Fed. Land	Other Non-Fed. Land	Total
<u>LAND TREATMENT</u>					
Soil Conservation Service	Acres	1,061		49,500	49,500
Cropland		450		47,000	47,000
Grassland			35,800	4,100	39,900
Technical Assistance			35,800	100,600	136,400
SCS Subtotal		1,511	35,800	100,600	136,400
Forest Service	Acres				
Forest Land		5,733		3,100	3,100
Technical Assistance			2,700	3,600	6,300
FS Subtotal		5,733	2,700	6,700	9,400
TOTAL LAND TREATMENT		7,244	38,500	107,300	145,800
<u>STRUCTURAL MEASURES</u>					
Construction					
Soil Conservation Service					
Multiple purpose Structure	No.	1	392,051	94,141	486,192
Recreation Facility	No.	1	45,350	45,350	90,700
Subtotal - Construction			437,401	139,491	576,892
Engineering Services					
Soil Conservation Service			54,500	2,500	57,000
Subtotal - Engineering			54,500	2,500	57,000
Project Administration					
Soil Conservation Service					
Construction Inspection			6,000		6,000
Other			19,448	6,862	26,310
Subtotal - Administration			25,448	6,862	32,310
Other Costs					
Land Rights			15,627	17,388	33,015
Subtotal - Other Costs			15,627	17,388	33,015
TOTAL STRUCTURAL MEASURES			532,976	166,241	699,217
TOTAL PROJECT			571,476	273,541	845,017
<u>SUMMARY</u>					
Subtotal - SCS			568,776	266,841	835,617
Subtotal - FS			2,700	6,700	9,400
TOTAL PROJECT			571,476	273,541	845,017

1/ Price Base - 1968 Prices.

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TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT

(At Time of Work Plan Preparation)

Fish Stream Watershed, Maine

Measures	Unit	Applied to Date <u>1/</u>	Total Cost (dollars) <u>2/</u>
<u>LAND TREATMENT</u>			
Soil Conservation Service			
Brush Control	Acres	25	275
Conservation Cropping System	Acres	25	25
Contour Farming	Acres	50	200
Cover and Green Manure Crop	Acres	50	2,000
Crop Residue Use	Acres	100	100
Cut-Back Border	Feet	100	100
Farm Pond	Number	10	8,000
Grassed Waterway or Outlet	Acres	5	107
Land Clearing	Acres	2	2,000
Obstruction Removal	Acres	24	24,000
Tile Drain	Feet	20,000	12,000
Tile System Structure	Number	10	150
Wildlife Habitat Preservation	Acres	10	50
SCS Subtotal	xxxxxx	xxxxxxxxxx	49,007
Forest Service			
Hydrologic Cultural Operations	Acres	172	4,469
Fire Control	Acres	12,722	12,722
FS Subtotal	xxxxxx	12,894	17,191
TOTAL	xxxxxx	xxxxxxxxxx	66,198

1/ SCS Measures Applied Through FY 1967, FS Measures Applied  
From FY 1956 through FY 1966.

2/ Price Base: 1967 Prices.

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TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Fish Stream Watershed, Maine

(Dollars) 1/

Item	Installation Cost PL-566 Funds				Installation Cost - Other Funds			Total Installation Cost
	Construction	Engineering	Land Rights	Total PL-566	Construction	Engineering	Land Rights	
Multiple Purpose Structure Site 1 Joint Costs	356,183	50,000	15,052	421,235	58,273	xxxxxxx	16,813	496,321 •
Specific Costs (Clearing of Recreation Pool)	35,868	2,000	xxxxxxx	37,868	35,868	xxxxxxx	xxxxxxx	73,736
Recreational Facilities	45,350	2,500	575	48,425	45,350	2,500	575	96,850
Subtotal	437,401	54,500	15,627 <sup>3/</sup>	507,528	139,491	2,500	17,388 <sup>2/</sup>	666,907
Project Administration	xxxxxxx	xxxxxxx	xxxxxxx	25,448	xxxxxxx	xxxxxxx	xxxxxxx	32,310
GRAND TOTAL	437,401	54,500	15,627	532,976	139,491	2,500	17,388	699,217

1/ Price Base - 1968.

2/ Includes \$500 for survey, legal fees and other costs, \$2,000 for relocation of utility line, and \$7,000 for raising highway and bridge.

3/ Includes \$2,000 for relocation of utility line and \$7,000 for raising highway and bridge.

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TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Fish Stream Watershed, Maine

(Dollars) 1/

Item	COST ALLOCATION			COST SHARING					
	PURPOSE			PL-566			Other		
	Flood Preven.	Recrea- tion	Total	Flood Preven.	Recrea- tion	Total	Flood Preven.	Recrea- tion	Total
Multiple Purpose Site No. 1	335,111	161,210	496,321	333,851	87,384	421,235	1,260	73,826	75,086
Clearing of Recreation Pool		73,736	73,736		37,868	37,868		35,868	35,868
Recreation Facilities		96,850	96,850		48,425	48,425		48,425	48,425
GRAND TOTAL	335,111	331,796	666,907	333,851	173,677	507,528	1,260	158,119	159,379

1/ Price Base: 1968.

August 1969

TABLE 2B - RECREATION FACILITIES  
(Estimated Construction Costs)

Fish Stream Watershed, Maine  
(Dollars) 1/

Item	Unit	Number	Estimated Unit Cost	Total Const. Cost
Access Road (black top 20' wide)	Feet	1,550	12.0 <u>2/</u>	18,600
Bathhouse and Toilet Facilities (flush)	Number	1	16,500 <u>2/</u>	16,500
Vault Toilet (boat launching area)	Number	1	1,400 <u>2/</u>	1,400
Beach Development	Number	1	3,600 <u>2/</u>	3,600
Boat Dock	Number	1	600	600
Boat Launching Ramp	Number	1	1,700 <u>2/</u>	1,700
Electrical System	Number	1	2,800	2,800
Gate (coin-operated)	Number	1	2,165	2,165
Nature Trail	Mile	0.5	600	300
Parking Areas (two blacktop)	Acre	1.25	20,500 <u>2/</u>	25,625
Picnic Area Site Preparation	Acre	2.0	1,000	2,000
Picnic Area Service Road (gravel)	Feet	1,250	2.0	2,500
Picnic Tables (8' - heavy plank)	Number	31	50	1,550
Charcoal Grills (on poles)	Number	21	40	840
Picnic Shelter	Number	1	1,500	1,500
Refuse Containers (permanent)	Number	15	20	300
Playground Site Preparation	Acre	0.6	1,000	600
Swings (6 seat)	Number	2	225	450
Slides	Number	2	220	440
Sand Boxes	Number	2	30	60
See-Saws (6 unit)	Number	1	240	240
Monkey Bar	Number	1	105	105
Septic Sewage System	Number	1	3,500	3,500
Signs	Number	25	25	625
Water Supply System	Number	1	2,700	2,700
GRAND TOTAL	xxxxxxx	xxxxxx	xxxxxxx	90,700

1/ Price Base - 1968.

2/ Includes clearing, site preparation, and landscaping.

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TABLE 3 - STRUCTURE DATA  
WATER IMPOUNDING STRUCTURES  
Fish Stream Watershed, Maine

Item	Unit	Site 1
Class of Structure		c
Drainage Area		
Controlled	Sq. Mile	22.26
Curve No. (1 day) (AMC II)		76
Tc	Hours	5.75
Elevation Top of Dam	Feet	604
Elevation Crest Emergency Spillway	Feet	590
Elevation Crest High Stage Inlet	Feet	573
Maximum Height of Dam	Feet	70
Volume of Fill	Cu. Yards	338,000
Total Capacity (Ee)	Acre Feet	6,020
Sediment Submerged 1st 50 years	Acre Feet	58
Sediment Submerged 2nd 50 years	Acre Feet	59
Sediment Aerated	Acre Feet	19
Recreation	Acre Feet	1,693
Retarding	Acre Feet	4,191
Surface Area		
Sediment Pool	Acres	23
Recreation	Acres	168
Retarding Pool	Acres	335
Principal Spillway		
Rainfall Volume (areal) (1 day)	Inches	5.12
Runoff Volume (10 day)	Inches	10.1
Capacity of High Stage (Max.)	cfs	592
Frequency Operation - Emergency Spillway	% Chance	1.0
Size of Conduit (Dia.)	Inches	54
Emergency Spillway		
Rainfall Volume (ESH) (areal)	Inches	7.54
Runoff Volume (ESH)	Inches	4.75
Type		Rock
Bottom Width	Feet	100
Velocity of Flow ( $V_e$ )	Ft./Sec.	6.9
Slope of Exit Channel	Ft./Ft.	0.03
Maximum Water Surface Elevation	Feet	591.83
Freeboard		
Rainfall Volume (FH) (areal)	Inches	18.4
Runoff Volume (FH)	Inches	15.09
Maximum Water Surface Elevation	Feet	603.7
Capacity Equivalents		
Sediment Volume	Inches	0.12
Retarding Volume	Inches	3.53

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TABLE 4 - ANNUAL COST  
Fish Stream Watershed, Maine  
(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost <u>2/</u>	Operation and Maintenance Cost	Total
Multiple Purpose Site 1 and Recreation Facilities	31,185	6,200	37,385
Project Administration	1,511	xxxxxx	1,511
GRAND TOTAL	32,696	6,200 <u>3/</u>	38,896

1/ Price Base: Installation - 1968 Prices  
O & M - Adjusted Normalized Prices.

2/ 100 years @ 4 5/8 percent interest.

3/ Includes \$5,200 for operation, maintenance, and replacement for the recreational facility development.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Fish Stream Watershed, Maine(Dollars) 1/

Item	Estimated Average Annual Damages		Damage Reduction Benefit
	Without Project	With Project	
Floodwater <u>2/</u>			
Agricultural	1,374	9	1,365
Non-Agricultural			
Urban			
Residential	535	0	535
Commercial	7,175	235	6,940
Railroad	422	0	422
Road and Bridge	2,964	0	2,964
Subtotal	12,470	244	12,226
Indirect	2,064	40	2,024
TOTAL	14,534	284	14,250

1/ Price Base - Adjusted Normalized Prices.2/ Damages and benefits will accrue from floods of greater magnitude than 100-year frequency.

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Fish Stream Watershed, Maine  
(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS <sup>1/</sup>						<sup>3/</sup> Average Annual Cost	Benefit-Cost Ratio
	Damage Reduction	Changed Land Use Urban	Recreation	Redevelopment	Secondary	Total		
MP Site 1 and Recreation Facilities	13,780	3,057	64,196	8,609	7,948	97,590	37,385	2.6:1.0
Project Administration	xxxxxxx	xxxxx	xxxxxxx	xxxxx	xxxxx	xxxxxxx	1,511	xxxxxxx
GRAND TOTAL	13,780 <sup>2/</sup>	3,057	64,196	8,609	7,948	97,590	38,896	2.5:1.0

<sup>1/</sup> Price Base: 1968

<sup>2/</sup> In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$470 annually.

<sup>3/</sup> From Table 4.

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## SECTION II

### INVESTIGATION AND ANALYSIS

#### Economics

A total of four evaluation reaches were used for making the economic studies. Floodwater damages and benefits were computed using the frequency method of analysis as described in Chapter III of the Economics Guide for Watershed Protection and Flood Prevention.

Information on agricultural, residential, business, and commercial floodwater damages was obtained by interviewing the floodplain property owners. Damages to the railroad were obtained from railroad officials. Damages to roads and bridges were obtained from state highway officials and local maintenance crews.

Damages were related primarily to the 100-year storm and computed with and without the project. Damages from the floods of September 1954, August 1962, and November 1966, were used as the basis for developing the stage-damage data. Damages were computed for floods up to and including the 100-year frequency event. The reduction of damages created by project measures was considered the damage reduction benefit (Table 5).

Indirect damages were estimated to be 20 percent of direct damages for urban property, roads, bridges, and railroads and 10 percent of direct damages for agricultural property.

Savings in future bridge replacement costs were estimated for the Route 11 bridge directly below Site No. 1 (TSC - Technical Notes - Watersheds UD-6.)

All benefits were converted to adjusted normalized prices based on "Interim Price Standards for Planning and Evaluating Water and Land Resources," Water Resources Council, April 1966.

Recreation benefits were based on the expected amount of visitor days of recreation use on multiple purpose site 1, considering picnicking, swimming, boating and nature trails. Benefits from other recreational use were not claimed. The estimate of use was based on procedures outlined in TSC - Technical Notes - Recreation UD-2 and UD-3. A value of \$1.50 per visitor day was used in determining the benefits. The resulting benefits were lagged for five years.

Benefits from changed land use (urban) were estimated from information obtained by interviewing local people and recent trends in the area. Benefits were computed on the basis of the expected net income from rental.

Redevelopment benefits were based on local labor employed during project installation and operation and maintenance. Local labor employed was estimated to be 25 percent of construction costs and 50 percent of operation and maintenance costs. Benefits from employment of local labor in operation and maintenance were limited to a twenty year period.

Secondary benefits were estimated to be 10 percent of direct project benefits. All secondary benefits were local in nature and were not considered from a national viewpoint.

Installation costs of structural measures were amortized at 4 5/8 percent interest for the 100-year life of the project. Costs of multiple purpose site 1 were allocated to purpose by the "use of facilities" method of cost allocation. Costs assigned to sediment storage were allocated in full to flood prevention, as the benefits from the alleviation of sediment damage were assumed to equal the assigned costs. Installation costs were based on 1968 prices. Operation and maintenance costs were based on adjusted normalized prices.

### Hydrology and Hydraulics

General: The hydraulic and hydrologic analysis of the watershed followed standard procedures of the Soil Conservation Service National Engineering Handbook and other technical references as listed in this summary.

Basic Data: Precipitation records as published in the Climatological Data by the U.S. Department of Commerce are available for stations at Houlton, Millinocket, Greenville, and Patten. Additional precipitation data for the April 1923 storm were obtained from the National Weather Records Center in Ashville, North Carolina.

No stream gage data are available for Fish Stream or the immediate area.

Watershed Analysis: A study of the hydrologic and hydraulic conditions of the watershed was made considering such factors as geology, land use, soils, topography, stream channel characteristics, potential floodwater retarding structure locations, and floodwater damage locations. From this study the watershed was divided into six subareas.

Hydrologic classification of soils in the watershed was obtained from maps prepared by Soil Scientists of the Soil Conservation Service.

Runoff curve numbers for forest land, under present and future conditions, were determined by the U.S. Forest Service on Soil Conservation Service soil classification on a study of forest cover conditions in the watershed.



Land use and treatment classes for present and "with project" conditions were prepared by the Watershed Work Plan Staff with the assistance of the District Conservation and Soil Scientist. Runoff curve numbers were computed from this data for land use areas other than forest as outlined in Chapter 9, Soil Conservation Service National Engineering Handbook, Section 4, Hydrology (NEH-4). Composite runoff curve numbers were then computed for each subarea.

Time of concentration for each subarea was computed using stream channel hydraulics, and overland flow, as outlined in Chapter 15, Soil Conservation Service National Engineering Handbook, Section 4, Hydrology (NEH-4). The times of concentration were also computed using the SCS Engineering Standard (ES) Drawing 1015. Travel time for each reach was computed using Manning's formula.

Channel and valley, dam, or bridge and road cross sections were surveyed at 23 selected locations.

Key Storm Analysis: Four major floods were considered. These were the April 1923 flood, the September 1954 flood, the August 1962 flood, and the November 2-3, 1966 flood. The 1966 storm provided the best data and was used as an evaluation storm. Approximately 5.5 inches of rain fell in this area during a 40-hour period. A rainfall distribution curve for this storm was developed based on the USGS rainfall gages at Greenville, Houlton, Skowhegan, and Millinocket. This actual storm was routed through the structure site with the evaluation storms.

The peak discharges and associated stages were compared with available high watermarks to establish correct hydraulic parameters for the watershed. The analysis of this storm placed the approximate return period at thirty years. The approximate return period of the 1954 storm was placed at 45 years.

Evaluation Series: The 10-, 50-, and 100-year frequency synthetic storms were used to obtain runoff frequency estimates.

The 12-hour durations for these frequency rainfalls were determined from U.S. Department of Commerce, Weather Bureau Technical Paper No. 40.

Hydrographs for all subareas were developed for each storm using the Soil Conservation Service Central Technical Unit method of hydrograph development. All controlled and uncontrolled subareas were routed individually through the appropriate reaches by lagging and by direct addition due to the short travel times throughout the reaches.

Discharge-frequency curves were plotted on logarithmic-normal paper at all reaches studied for present conditions with and without land use and treatment. The frequency line for "with project" conditions was constructed in a similar manner using peaks produced by the routed uncontrolled area with land use and treatment conditions combined with the routed release from the structure.

Rating Curves: Rating curves showing the relationship between stage and discharge were developed at strategic locations throughout the damage reaches. Water surface profiles were computed through all reaches using the modified Leach's method described in Chapter 14, Soil Conservation Service National Engineering Handbook, Section 4, Hydrology (NEH-4).

Stream profiles were plotted for the reaches on plan-profile kodagraph sheets (see appendix). The plan portion is an enlargement of an aerial photograph of the reach. On this base map are shown the cross section locations and the 100-year frequency floodplain limits for both with and without project conditions. The profile is plotted showing elevations of start of damage, bridge, and road data, first floor of critical property, flood high watermarks, 100-year without project condition, and 100-year with project condition flood profile.

Structural Design Criteria: The minimum required temporary flood storage for the structure was determined as outlined in Chapter 21, NEH-4, Hydrology, Part I - Watershed Planning, 1965. The principal spillway hydrograph routing was established using quick return flow. The total design temporary storage was computed as 1.17 times the minimum required storage, plus the amount of design drawdown storage. This drawdown storage was computed as the amount in excess of 20 percent of the design minimum flood storage remaining in the reservoir after a 10-day drawdown period with quick return runoff.

The structure site analysis was performed using the computer program DAMS. The structure site was evaluated for four stages of development using ten principal spillway release rates.

Curves of discharge versus required storage and discharge versus emergency spillway crest elevation were developed. The alternatives giving the most economical combination of cost and downstream control were selected.

Emergency spillway and freeboard hydrographs were developed by procedures in Chapter 21, NEH-4. Precipitation data were obtained from Soil Conservation Service Engineering Standard Drawing 1020 (ES-1020).

### Engineering

Selection of the structural works of improvement for flood prevention was based on the findings of the economic, hydrologic, and geologic studies of existing conditions and the effects of alternative combinations of structural measures.

Structure classification was based on the amount of storage retained in the site and the proximity of the site to its immediate damage center. The site was reviewed by the State Conservation Engineer and has been planned as a class "c" structure.

A base map of the watershed was prepared showing the watershed boundary, the drainage pattern, and the road system. Aerial photographs were used to locate probable structure sites.

A field reconnaissance was made of all probable structure sites. The site considered for study was the one with the best available storage at the most economical location.

A detailed topographic map of the pool area was made on a photographic base by the plane table method. A detailed topographic map of the structure site was also made by the plane table method. All elevations were tied to mean sea level datum. These maps were used to determine storage capacity, pool sizes, area inundated by temporary flood pool, the location of physical features, and to make a cost analysis of the structure. Soil suitabilities were considered in estimating the cost of the recreation development. Several associated public recreational development alternatives were developed for the site at the sponsors' request.

Fill and excavation volumes were based on a profile developed from the topographic map for the site. These quantities were computed by the centerline height method.

All preliminary designs are in accordance with Soil Conservation Service design criteria as set forth in Engineering Memorandum SCS-27 (Rev.); Section 4, Chapter 21, National Engineering Handbook; U.S. Weather Bureau Technical Papers 40 and 49; and other sources of recognized engineering material.

The Upper Darby I.B.M. 1130 Computer was utilized in making a reservoir operations study and numerous routings of the principal spillway system and the emergency spillway and freeboard storms. Fill volumes, emergency spillway excavation, principal spillway costs and land rights costs were all evaluated to determine the most economically proportioned structure.

Sediment storage volume to be provided is based on the expected accumulation during a 100-year period for the structure.

Final design for all structural works of improvement will be submitted to the Maine Public Utilities Commission.

### Geology

General: The methods and detail of investigation in the Fish Stream Watershed follow guidelines as set forth in TR-17, "Geologic Investigations for Watershed Planning" and "Standards for the Preparation and Assembly of Basic Geologic Data," Engineering and Watershed Planning Unit, Upper Darby, Pennsylvania.



Basic Data: A complete review of the geologic literature, maps, and general references was made to obtain information relating to the regional geology, rock types, rock structure, glacial deposits, local problems, and groundwater conditions.

Topographic maps and aerial photographs were studied in order to evaluate watershed conditions.

A field examination was made in all accessible portions of the watershed. Pertinent information was recorded on U.S.G.S. 15-minute quadrangle maps and 1" = 400' plane table maps of the site area. Outcrops and roadcuts were examined; streamflow, water table, and streambed conditions were observed; and general land use and water storage conditions were noted. Geologic features were located and used to establish geologic correlation in the watershed. Sediment and erosion damages were evaluated.

The site investigation was made by geophysical methods with some correlation to existing exposures. Backhoe test holes were utilized in outlining available borrow.

Sediment and Erosion: A field examination was made to determine sediment damages and areas of critical erosion. There is no agricultural land involved in the floodplain. Sedimentation damages are minimal and are limited to minor lawn and road accumulations. Gully, roadbank, and streambank erosion are minor sources of sediment and were not considered on an individual basis. The base level of Fish Stream is maintained by bedrock ribs and the stream is generally in a stable condition.

Sheet erosion for the watershed was determined by the Musgrave soil loss formula and checked with the Universal method. The watershed is 87 percent forest land and under generally good cover. Soil losses are low and no critical erosion areas were determined as affecting the structure site or benefit area.

Groundwater: A study was made to determine the influence of the proposed structure on the groundwater conditions in the area. A general rise of the groundwater table can be expected in the immediate area surrounding any permanent lake development. Downstream from the site little or no effect will be noted. Useable amounts of groundwater are generally only available from bedrock aquifers. If any effect is noted, it will be that of improved discharge from wells located in the stream area immediately downstream from the site.

Development in the area surrounding a permanent pool should note the low soil permeability, the shallowness of the soils in some areas, and the generally high water table.

Site Investigations: The Fish Stream site is situated in a moderately steep-sided valley. The abutments are mantled with glacial till (silty sandy gravel); however, erosion has reduced the original thickness of this material and bedrock outcrops are numerous. The right abutment is extremely shallow to rock, usually less than 4'.

The left abutment is somewhat deeper, but is not believed to exceed 20'. Bedrock is exposed in the stream channel at the centerline. Bedrock is composed of slate, quartzite and biotite schist. Depth of weathering in bedrock is believed to be less than 2'. A limited deposit of water-laid sand and gravel is located adjacent to the stream through the site area. A detailed backhoe test hole evaluation was made to locate adequate and suitable borrow for the structure. Limited lab testing was made on samples from a potential area. A good source is located in openland about 2,500' south of the site.

The following items were considered in the engineering evaluation and work plan costs:

1. Bedrock excavation in the emergency spillway.
2. Possible permeable nature of the bedrock.
3. Location and amounts of suitable borrow.
4. Need of detailed site investigation.

#### Fish & Wildlife

The United States Department of the Interior, Fish and Wildlife Service, with assistance from the Maine Department of Inland Fisheries and Game, analyzed the effects of the project on fish and wildlife resources and submitted a reconnaissance report on the watershed. Their recommendations are as follows:

1. That three to four feet high stumps be left standing in the marsh area of the proposed impoundment to prevent boating intrusion.
2. That the Maine Department of Inland Fisheries and Game have complete jurisdiction over the management of the fish and wildlife resources of the 31-acre marsh that will be created by the impoundment.
3. That recreational facilities not be developed adjacent to the marsh area.
4. That the four-foot deep channel be extended from the discharge outlet downstream to the first natural shade where normal stream conditions exist.
5. Should oxygen deficiency conditions occur in the impoundment and rough fish flourish in the reservoir, the Maine Department of Inland Fisheries and Game will determine whether or not a rough fish eradication program is feasible and necessary. If determined to be feasible and necessary, that agency will carry out the program.



In addition, the Maine Department of Inland Fisheries and Game has indicated the following:

1. If the pond habitat develops to be good trout habitat, the Department will consider it the same as any other good trout habitat and it will be stocked accordingly.
2. If the pond habitat develops to be marginal as trout habitat, the Department will not be required to stock the pond unless it is biologically sound and feasible to do so.

#### Forest Land

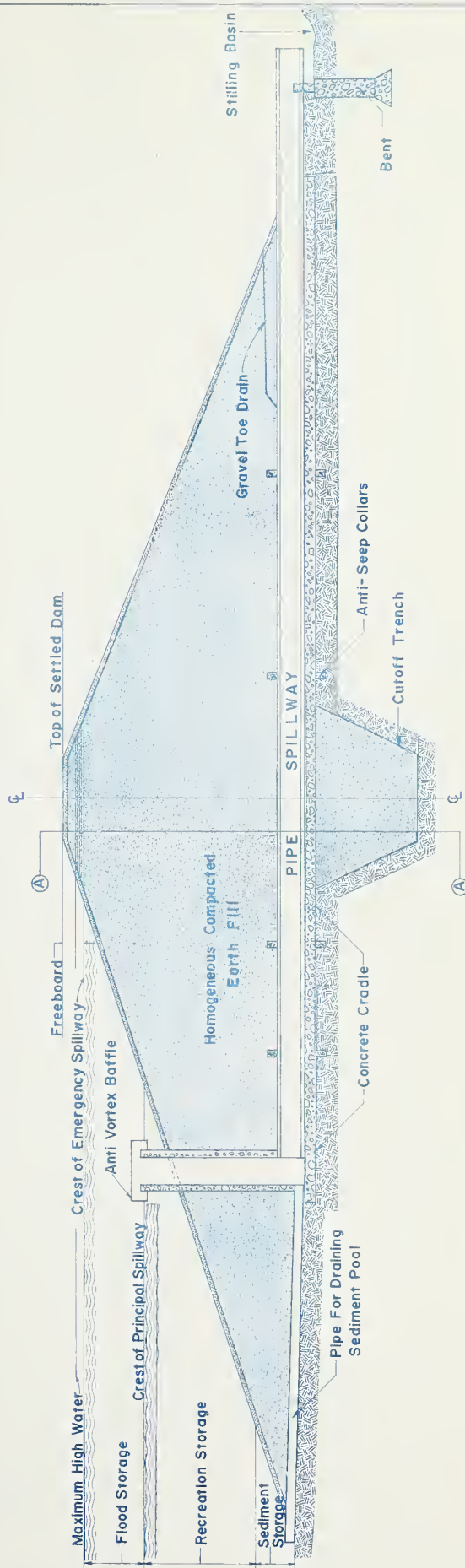
Information on the hydrologic condition of the forest land in the watershed and the reasons for the present hydrologic condition were obtained in a series of systematically selected observation plots. This information served as the basis for developing precipitation-runoff curve numbers and land treatment needs for forest land. The data obtained included measurements of the litter and humus layers, determination of soil type, and other hydrologic factors, and recording the presence or absence of disturbance factors such as fire, grazing, cutting, logging, and the abnormal infestation of insects or disease which might adversely affect hydrologic condition or increase fire hazard. Forest fire protection is being provided by the Maine Forest Service in cooperation with the U.S. Forest Service through the Clarke-McNary Cooperative Fire Control Program (CM-2). Five year fire statistics and goals (1962-1966) are as follows:

<u>Forest Area</u> (acres)	<u>Average Annual Burn</u>		<u>Statewide</u> (percent)	<u>Fire Index Goal</u> <u>Statewide</u> (percent)
	<u>Watershed</u> (acres)	(percent)		
12,722	.00	.00	.02	.05

The watershed's fire loss index goal is 0.05 percent or 0.5 acre per thousand acres protected per year. Established watershed and State goals have been met and the present degree of protection afforded by Federal and State agencies is adequate to meet any increased hazard and risk resulting from the project's installation.



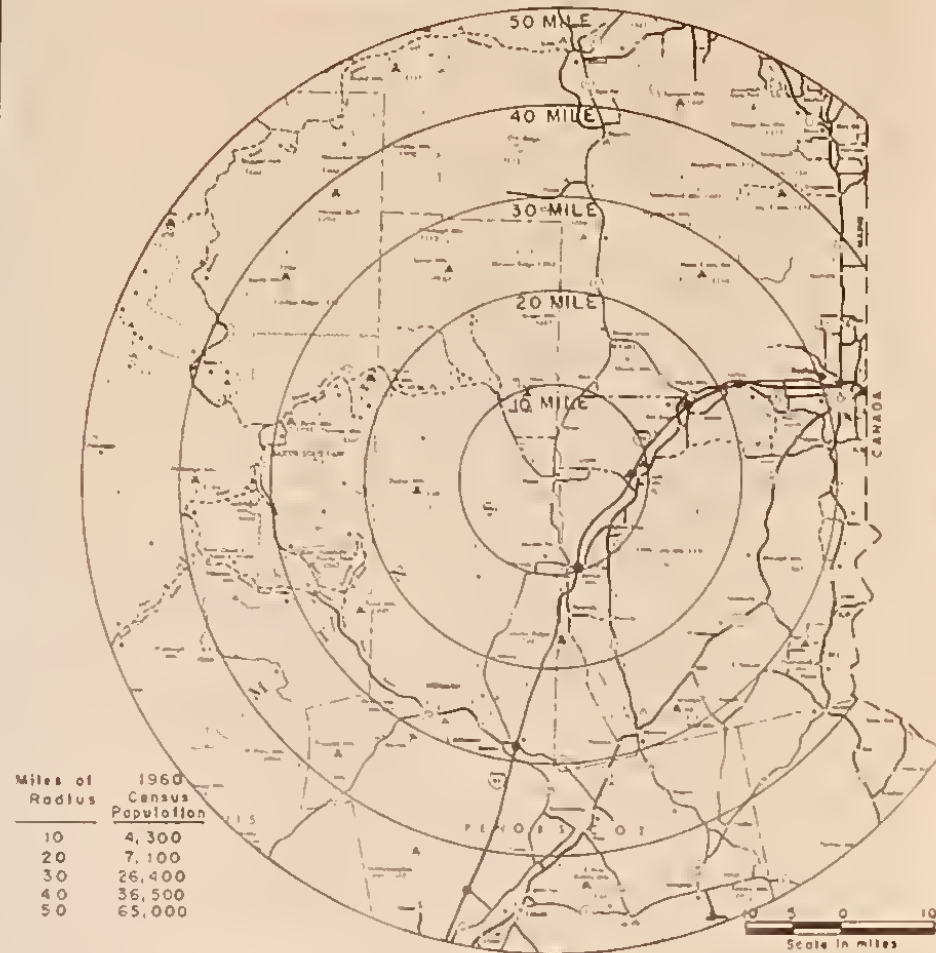
# SECTION A-A CROSS SECTION OF EMERGENCY SPILLWAY CONTROL SECTION



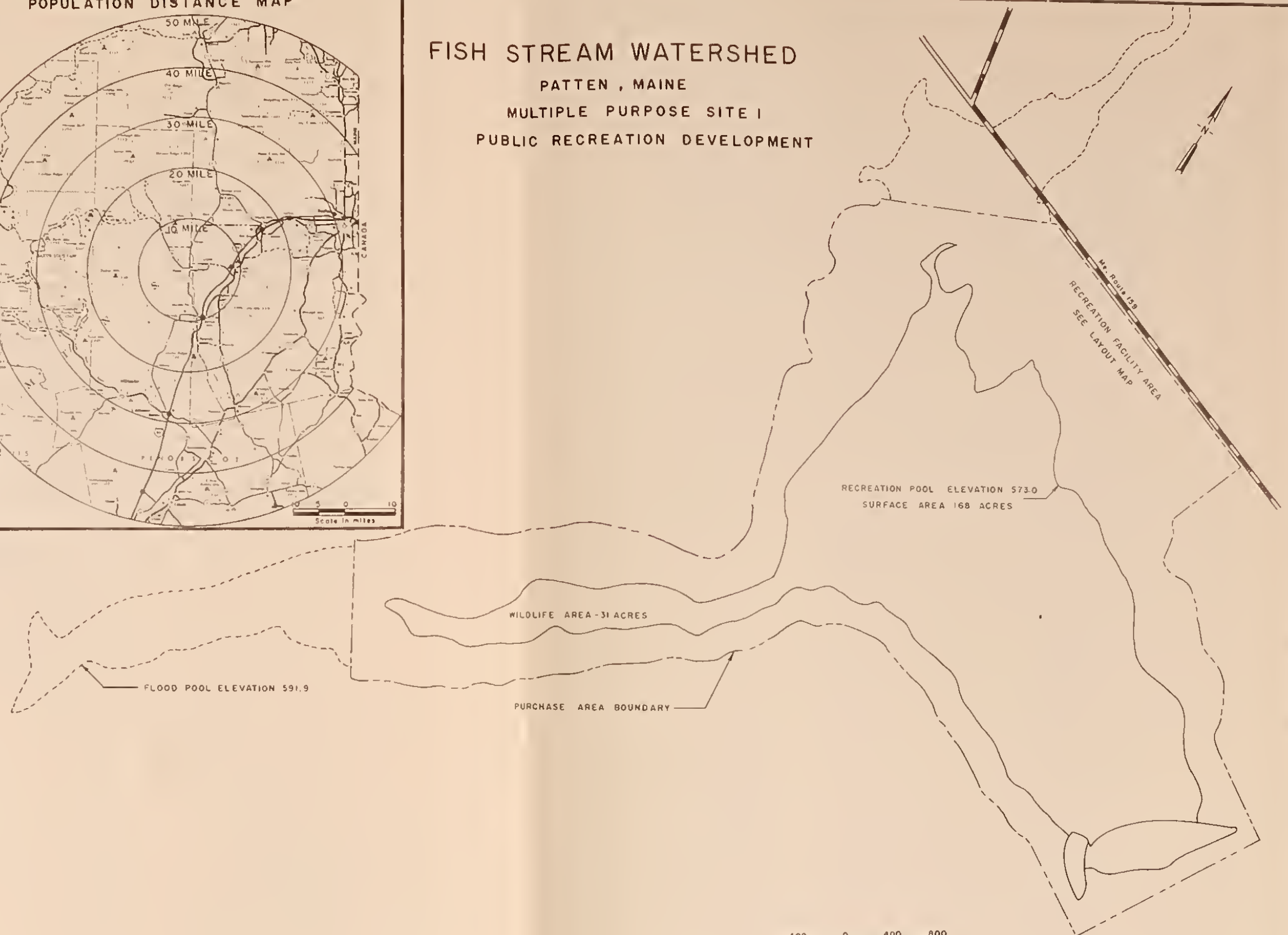
TYPICAL CROSS SECTION OF FLOODWATER RETARDING STRUCTURE  
ALONG PRINCIPAL AND EMERGENCY SPILLWAYS



# POPULATION DISTANCE MAP



## FISH STREAM WATERSHED PATTEN, MAINE MULTIPLE PURPOSE SITE I PUBLIC RECREATION DEVELOPMENT





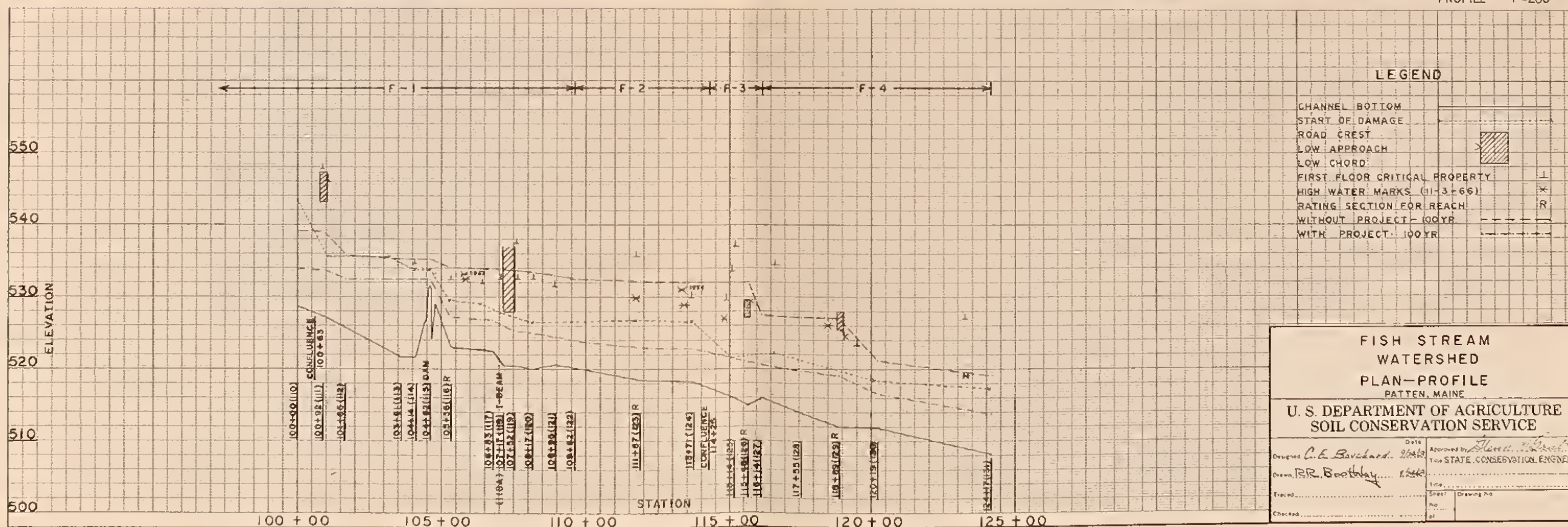








SCALE: PLAN 1" = 124' PROFILE 1" = 200'









68° 30'

U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

PROJECT MAP  
FISH STREAM WATERSHED  
PENOBSCOT COUNTY, MAINE

1 1/2 0 1 Mile

T4  
R7

D.A. 14,246 Ac.

M O U N T A I N  
C H A S E

P A T T E N

① R



Drainage Area Controlled  
by Structure

Area Benefited

D.A.

Drainage Area In Acres

PROJECT MEASURES



Multiple Purpose Structure  
(R-Recreation)

68° 30'

November 1968







